

The Scottish Mathematical Council

www.scot-maths.co.uk

MATHEMATICAL CHALLENGE 2016–2017

Entries must be the unaided efforts of individual pupils.

Solutions must include explanations and answers without explanation will be given no credit.

Do not feel that you must hand in answers to all the questions.

CURRENT AND RECENT SPONSORS OF MATHEMATICAL CHALLENGE ARE

The Edinburgh Mathematical Society, The Maxwell Foundation, Professor L E Fraenkel,

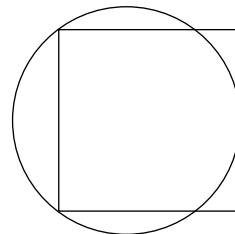
The London Mathematical Society and The Scottish International Education Trust.

The Scottish Mathematical Council is indebted to the above for their generous support and gratefully acknowledges financial and other assistance from schools, universities and education authorities.

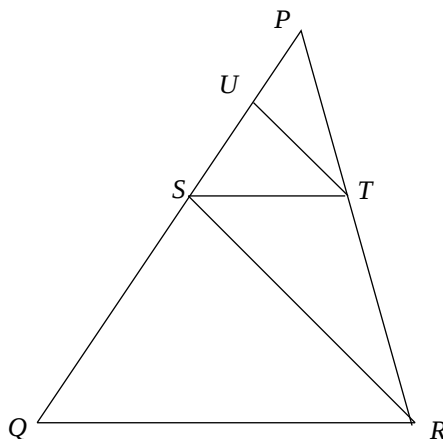
Particular thanks are due to the Universities of Aberdeen, Edinburgh, Glasgow, Heriot Watt, St Andrews, Stirling, Strathclyde and to Bearsden Academy, Kelvinside Academy and Northfield Academy.

Senior Division: Problems 2

- S1. In the diagram the square has two of its vertices on the circle of radius 1 unit and the other two vertices lie on a tangent to the circle. Find the area of the square.



S2.



In the diagram ST is parallel to QR , UT is parallel to SR , $PU = 4$ cm and $US = 6$ cm. Find the length of SQ .

- S3. Show that the equation of any circle passing through the points of intersection of the ellipse $(x + 2)^2 + 2y^2 = 18$ and the ellipse $9(x - 1)^2 + 16y^2 = 25$ can be written in the form

$$x^2 - 2ax + y^2 = 5 - 4a$$

where a is a constant.

- S4. There are 6 pairs of siblings from 6 different families.
- (a) How many ways can they be divided into two teams so that both siblings of a pair are never in the same team?
 - (b) How many ways can they be divided into three teams so that both siblings of a pair are never in the same team?

SEE OVER FOR QUESTION S5.



Mathematical Challenge Problems 2

SENIOR DIVISION 2016-2017

PLEASE USE CAPITALS TO COMPLETE

SURNAME

OTHER NAME(S)
(underline the one
you prefer)

SCHOOL

AGE

YEAR OF STUDY

S

FOR OFFICIAL USE

Marker

Marks

1	2	3	4	5

Total

— — — — - C U T A L O N G H E R E — — — —

Please write your solutions on A4 paper and staple the above form to them.

PLEASE WRITE YOUR NAME ON EVERY PAGE.

Send your entry through your school to the section organiser.

For further information on the competition, please see the Information Circular, which has been distributed to all secondary schools. Please contact the local organiser, whose name and address are given above, if you require a further copy.

- S5.** Two forgetful friends agree to meet in a coffee shop one afternoon but each has forgotten the agreed time. Each remembers that the agreed time was somewhere between 2 pm and 5 pm. Each decides to go to the coffee shop at a random time between 2 pm and 5 pm, wait for half an hour, and leave if the other doesn't arrive. Find the probability that they meet.

END OF PROBLEM SET

CLOSING DATE FOR RECEIPT OF SOLUTIONS :

14 February 2017

Look on the SMC web site:

www.scot-maths.co.uk

for information about Mathematical Challenge